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COMMENTS FROM CHO

A short cycle impregnation (SCI) is an impregnation process taken advantage of the following.

- The direct contact of CO2 and the tobacco provides a fast heat transfer rate.
- Fast treatment of heat of compression can be made by minimization of the void space effect with a high tobacco bulk density
- No separate process step is required to remove the heat of compression because the heat of compression is not localized and not formed at the end of the final pressurization since the NET process allows the CO2 condensation occurs during pressurization.
- The high tobacco bulk density allows a fast pressurization, flow-through and vent without tobacco bed disturbance.
- The vent rate creates no significant effect on the tobacco post vent temperature.
- Sufficiently adequate amount of CO2 retention and impregnation stability can be achieved without any soak time under the final impregnation presure when the impregnation pressure is higher than 750 psig for the 15% O.V. tobacco.

The SCI provides the following benefits:

- It allows less impregnation stability consequently allows a higher tobacco post vent temperature.
  The higher tobacco post vent temperature requires less thermal treatment which may result in tobacco taste closer to its original taste.
  The less stabilility requirement may allow lower impregnation pressure.
- It requires a smaller process equipment (snch as impregnator, bulking storage) consequently requires less capital cost.
  It reduces amount of inert gas to maintain the impregnation level before expansion process since it requires a smaller bulking storage.
- It reduces the CO2 usage for an unit of tobacco weight processed consequently reduces operating cost and CO2 emmision.

The SCI requires a prevention of the snow ball effect caused by the rapid cycle.
The snow ball effect may be prevented by

- Control the supply CO2 temperature to avoid liquid CO2 formation on the supply line before CO2 contacts on the tobacco during the 1st pressurization.
- Remove liquid CO2 formed on the system other than tobacco in the 2nd pressurization step during and/or after the vent before the next pressurization cycle.
  The removal of the liquid CO2 presented on the system other than tobacco may be achieved by high velocity during vent or by applying heat to the system after vent and before the next pressrization step.
- The CO2 vent path may coated with a low heat conductive material.

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NET can process higher bulk density.

NET produces an uniform impregnation in view of the condensation.

Liquid condensation prevents localized heat of compression?
Amount of liquid condensation on the tobacco surface is equal throughout. (This is true because the condensation occurs when gas passes through the 1st layer which provides the saturated gas for the next layer and taking care of the heat of compression on that layer to condense? 1st heat of compression and then condensation?)

NET provides a freedom of gas flow direction during vent (Vertical, Horizontal and Radial).

Benefit in view of effect of HEAT of COMPRESSION
- Less amount of heat from smaller compression ratio (0 to 850 psig Vs 250 to 850 psig)
- More available CO2 to cool the heat of compression from condensation

Benefits from HIGH BULK DENSITY
- Provides an uniform bulk density since we do not rely on the gravity alone.
- Uniform density provides uniform gas flow, uniform precool temperature and uniform condensation.
- Allows a higher gas velocity during p-up, flow-through and vent without movement of tobacco bed.
- Requires smaller process equipment (Impregnator, bulking storage) - less capital cost
- Less CO2 loss - higher efficiency
- Min. void space (Prevent tobacco settlement during process, ie; gravity gas flow)

SCI:
- Allows higher PVT
- Allows less impregnation stability.
- Requirement of less stability provides a shorter hold time under pressure for low pressure impregnation.
- Provides uniform product since we process a small quantity.

AVAILABLE DATA ?????
- No hold time is required for the impregnation pressure being higher than 750 psig.
- Under a fixed impregnation pressure
  1. Soak time Vs CO2 retention
  2. Soak time Vs Stability
- PVT is not function of the vent rate. Fast vent is OK.
- Effect of VOID SPACE
  1. During p-up - Heat of compression @ top and Cold @ inlet (or bottom)
  2. During vent

SNOW BALL EFFECT